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CLAIMS

[Claim(s)]

[Claim 1]It is an integrated circuit which has at least one antenna (1) for transmitting data or energy by no contacting, it has a circuit flat surface arranged up and down -- the upper part of a circuit part which should protect said at least one antenna (1) -- and/or, it being arranged caudad and, said antenna (1) is a part of protection circuit -- an integrated circuit characterized by what said protection circuit supervises an integrated circuit for about invasion.

[Claim 2]it has a selection element (2) -- said selection element is assigned to at least one antenna (1) -- said selection element, The integrated circuit according to claim 1 characterized by what a function of an antenna as a part of protection circuit and a function of an antenna as a means for transmission of data or energy are set up for.

[Claim 3]The integrated circuit according to claim 2, wherein a selection element (2) is constituted so that a function of an antenna (1) may be set up by turns in time.

[Claim 4]A selection element (2) is constituted so that a signal may be supplied to an antenna (1) and said signal may be received from an antenna (1).
The integrated circuit according to claim 2 characterized by what said signal includes a disengageable protection circuit signal, and a sending signal and/or an input signal mutually for.

[Claim 5]The integrated circuit comprising according to claim 4:

A selection element (2) is a protection circuit signal.

A filter or a modulator for separating a sending signal and/or an input signal.

[Claim 6]An integrated circuit given [from Claim 1 to 5] in any 1 clause, wherein said at least one antenna (1) has covered at least a circuit part which should be protected mostly.

[Claim 7]An integrated circuit given [from 1 to 6, wherein said at least one antenna covers at least a circuit part which should be protected from the upper part and a lower part mostly to sandwich shape] in any 1 clause.

[Claim 8]An integrated circuit given [from 1 to 7, wherein said at least one antenna is spirally constituted in a circuit flat surface] in any 1 clause.

[Claim 9]It is provided for generating of at least one signal generator (3) of a protection circuit signal, it is provided for evaluation of a protection circuit signal with which at least one signal detector (4) was supplied from an antenna -- an integrated circuit given [from 1 to 8, wherein said signal generator and said signal detector are mostly covered at least by an antenna] in any 1 clause.

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DETAILED DESCRIPTION**[Detailed Description of the Invention]****[0001]**

It has an integrated circuit and the chip card in which the antenna attached to the chip card is formed is publicly known. It is possible to transmit data or energy to the integrated circuit of a chip card by no contacting with this antenna. Here, an antenna is constituted as a secondary coil of a transformer. Thereby, when a chip card fully approaches the primary coil in a terminal, voltage may be generated with an antenna. Thereby, energy can be supplied to an integrated circuit. It is also possible to transmit data to a chip card from the primary external coil in a terminal and to transmit data to the primary external coil in a terminal from a chip card. It has become clear that these chip cards are dramatically vulnerable to the analysis or the alteration by an outsider. Also to mechanical load, these chip cards will be dramatically vulnerable and cost will start again.

[0002]

The electronic circuit protected from the analysis and the alteration by an outsider by the special protection circuit including important information on security is publicly known. Various methods are described in order to obtain such protection. For example, metallic covering, for example, covering of silver or titanium, is provided in the integrated circuit which should be protected. Thereby, reading the circuit structure of an integrated circuit by an X-ray beam is prevented. The conductor path has been arranged as a protective shield conductor at the topmost part of the circuit flat surface of an integrated circuit, and it has become clear that it is effective to observe the physical characteristic, resistance, capacity, etc. For example, when undesirable observation or alteration is performed and change by a short circuit, ground connection, or cutting is detected, the trigger of the alarm signal is carried out. An integrated circuit is made to shift to the state where it is called safety mode, based on such an alarm signal. In this safety mode, the contents of the memory cell are not read any more, for example. It is because the information which the contents of the memory cell were thoroughly eliminated immediately after shifting to safety mode, for example, and was included in the inside with it is lost impossible [reproduction]. More than it of that this

reads the important information on the integrated circuit contained in program memory and data memory, for example, a code key, a pin number, or a user's individual data or altering becomes impossible. On circuit technology, this kind of protection circuit will be dramatically troublesome, and will require cost. It is because such a protection circuit needs a quite big chip area.

[0003]

In the integrated circuit which has an antenna for carrying out uncontacted transmission of data or the energy, SUBJECT of this invention is constituting so that the above-mentioned fault's can be conquered.

[0004]

From the integrated circuit which has the feature of Claim 1, these SUBJECT is solved according to invention.

[0005]

Another advantageous form of this invention is an object of dependent claim.

[0006]

This invention indicates an integrated circuit and the antenna is realized as some integrated circuits for uncontacted transmission of data and energy. Therefore, it is formed within the limit of the manufacturing process of an integrated circuit. Thereby, the following thing is possible. That is, it is possible to omit many electronic points of contact between an antenna and a receiving circuit, and to shorten the length of the transmission line from a receiving circuit or a receiving circuit to [from an antenna] an antenna in addition to it. This decreases the loss of the signal strength on a transmission line notably. Thereby, it becomes possible to constitute a die size smaller simply [transmitter / the antenna or receiver to the transmitted signal, and / to the signal which should be transmitted]. This makes an integrated circuit cheap. It has become clear that the integrated circuit which has an antenna is not so vulnerable to mechanical load. It is because the mechanical damage to a path cord or an antenna, i.e., destruction of the electric connection wire between the antenna and integrated circuit which are produced by the curve of a chip card, is eliminated. However, such a thing will happen in the circuit which has an external antenna which ***'s in a Prior art. Therefore, it has become clear that the integrated circuit of this invention which has an antenna is not so vulnerable.

[0007]

According to this invention, the antenna accumulated into the circuit is used also as a protective shield rather than is used [in addition] only as transmitting antennas. This protective shield is arranged at the upper part of a circuit part and/or the lower part which should protect an integrated circuit. This is attained as follows. That is, an antenna is installed in one circuit flat surface, and it is attained by being arranged to the circuit or circuit part which should be protected in the upper part of the circuit flat surface, and/or a lower part. As a part of protection circuit, a protection circuit signal is impressed to an antenna. This signal is transmitted via one or two or more conductor paths of an antenna,

and is inspected successively. If a significant point of difference is detected within the limit of an inspection, the trigger of the alarm signal will be carried out. This alarm signal makes an integrated circuit shift to safety mode. These points of difference are caused by change of the short circuit of the conductor path of an antenna, cutting or its physical characteristic, for example, resistance, capacity, etc. These change is identified, for example as invasion by penetration of the mechanical damage of each layer of an integrated circuit, and a protective shield, or contact of the conductor path of an antenna.

[0008]

A required chip area can be further decreased to the multiplex function of an antenna, i.e., the function as a transceiver component of as opposed to transmission of data at one side, and realization of the protected integrated circuit which has an antenna with the function as a protective shield of a protection circuit on the other hand. It is because it is possible for integrative use of an antenna to be offered, to simplify the measure for decoupling service wire still more nearly required for an antenna and a protection circuit, a leading line, and a track, and to lessen.

[0009]

In that case, a protective shield may be realized by the separate antenna also only with one antenna mutual [two or more]. By this kind of an antenna of multiple configuration, the following thing becomes possible. That is, it becomes possible it not only to transmit only another signal, but to distinguish spatially the invasion to the predetermined circuit part which should be protected, and to detect it according to the position of each antenna. It becomes possible to take separate measures like expected for protection of the circuit part generated from an applicable circuit part and there by this.

[0010]

This invention indicates one or two or more selection elements advantageously. This selection element is assigned to the antenna and sets up the function of the function of the antenna as a part of protection circuit, data, or the antenna as a transmission means of energy. Such function assignment can be performed as follows. That is, a protection feature or transmission functions exist at a certain time, and when it is a certain another back, it can carry out so that other functions may be offered. These two functions are alternatively set up by a selection element. This alternative setting out is performed by a fixed, for example, are regular, time raster. this boils signal evaluation of a protection circuit signal markedly, and makes it easy. Function assignment of an antenna is performed by time division multiplexing.

[0011]

In addition, it is also possible to **** the following signals at an antenna. That is, on the other hand, it is also possible to **** a signal suitable for enabling transmission of the data which should **** from an integrated circuit, and using it as a protection circuit signal on the other hand. This kind of signal is suitable for such a use, when it usually includes the disengageable protection circuit signal, and a sending signal and/or an input signal

mutually. This separation or combination is performed by the selection element. In separation, this selection element can be constituted as the frequency filter which has the high pass characteristic, the low pass characteristic, or a band-pass response, for example, or a demodulator. When it is the signal with which it was superimposed on a different frequency position, suitable selection of a filter can perform separation. It ****s in it and the following thing is also possible. That is, it is possible to take out the 2nd signal modulated on one signal, and to evaluate by use of a suitable demodulator separately from the 1st signal. In this case, both the combined common signals are transmitted via the conductor path of an antenna. In this case, an antenna is simultaneously used also as a part of protection circuit [as opposed to an integrated circuit as a transmission means of data and energy]. Thus, when an antenna has two or more functions simultaneously, detection of the invasion to the integrated circuit which has the protected circuit part at each arbitrary time is identified certainly.

[0012]

According to the advantageous embodiment of this invention, it follows with an antenna, and the conductor path of the antenna is constituted so that the integrated circuit which should be protected, or its circuit part may be covered flatly as follows almost ideally thoroughly. That is, it is that of a wrap so that a protection circuit cannot be directly arrived at by punching with the antenna on the circuit part which should be seen superficially and should be protected. That is, without damaging the conductor path of an antenna, it is that of a wrap so that a protection circuit cannot be arrived at. this -- enough -- or -- perfect -- a wrap, for example covering two or more circuit flat surfaces, things are two or more circuit flat surfaces, and become easy and certainly possible by forming a conductor path. It is because a conductor path must be mutually arranged by interval sufficient at one flat surface and must prevent a cross talk by that cause. The field between the conductor paths of the antenna in one certain circuit flat surface is exactly covered with the conductor path in another circuit flat surface. As a result, it becomes possible to cover thoroughly the circuit part which should be protected. The antenna which has a conductor path advantageously is constituted by the very narrow conductor path of width. This conductor path width ****s in the size of punching for the invasion to the circuit protected, or is smaller than it. It is made such, each punching leads to cutting of a conductor path, and the error signal detected further very certainly is acquired. Since it results in the short circuit between conductor paths with such various punching, this short circuit is identified as an error signal very certainly by a detector suitable as all-out invasion to a signal. It is possible by constituting the conductor path of an antenna as a very thin conductor path to realize the coiled antenna which has very many turns. It is made for the width of this conductor path to **** to the width of the thinnest conductor path on the predetermined chip technology currently used advantageously. The turn of these large number enables it to transmit most quantity of energy via an antenna. So, it has become clear that the antenna which has many turns dramatically fits especially the protection circuit that has a thin conductor path especially

the interval is mutually kept dense.

[0013]

Advantageously, the circuit part of one or more of an integrated circuit which should be protected is surrounded by sandwich shape with two or more antennas. As a result, the observation or the alteration of a circuit part arranged between antennas is eliminated [top] also from the bottom. Here, it is each best circuit flat surface or the lowest circuit flat surface of an integrated circuit, and has turned out for it to be advantageous to constitute an antenna flatly advantageously thoroughly. Thereby, the optimal transmission of data or energy is attained. It is because a shielding effect is obtained and it is not obtained depending on other flat surfaces of an integrated circuit only by the casing of an integrated circuit. The optimal protection of the circuit flat surface inside an integrated circuit is also obtained. It is because the circuit flat surface of this inside is thoroughly covered with the uppermost surface of a circuit and the lowermost surface of a circuit which have an antenna arranged at that inside and is protected by that cause. Therefore, invasion can be carried out via the side of an integrated circuit in which it has various circuit flat surfaces.

[0014]

It has turned out for it to be especially advantageous to constitute spirally an antenna or the antenna in a circuit flat surface. Thereby, many turns can be especially formed to one or more antennas easily on treatment technique. This antenna constituted spirally acts as a secondary coil of a transformer. The primary coil of a transformer is in a terminal and it is suitable for transmission and evaluation of the data of the chip card which has an integrated circuit by this invention. The data communications between a primary coil and a secondary coil, energy transmission, and its reverse are performed like the conventional transformer. That is, an alternating voltage signal is transmitted to the coil of another side from one coil, and it is performed here so that energy may also be additionally transmitted to the coil of another side from one coil in addition to the changing signal.

[0015]

According to the advantageous embodiment of this invention, the signal detector for evaluation of the protection circuit signal supplied from the signal generator and/or antenna for generating of a protection circuit signal is arranged under the uppermost surface of the circuit which has an antenna at a circuit flat surface, and is protected from the intervention which should be prevented according to the conductor path. A signal detector thru/or a signal generator are similarly arranged at a circuit flat surface above the lowermost surface of the circuit which has a conductor path of an antenna. Thereby, the structure of sandwich shape is acquired. This sandwich structure protects the signal detector thru/or signal generator of a protection circuit with the antenna in the circuit flat surface most besides an integrated circuit, and also protects circuit part with an another integrated circuit which should be protected. this SHISUTEMA -- by structure [tic], the cascade protection by the conductor path of one or more antennas is obtained to a signal generator thru/or a signal detector. Protection is obtained even against the remaining portion of an integrated circuit

by the conductor path of the antenna which has a signal generator and a signal detector. Based on protection of the conductor path on one or more antennas, observation or an alteration of a signal generator thru/or a signal detector is prevented by this arrangement configuration. This has eliminated the possibility of another invasion, i.e., a possibility that a signal will be directly supplied without a detour to a signal detector via a conductor path. Therefore, it has become clear that it is a means suitable for this kind of arrangement configuration especially raising the protective action of the protection circuit which has the attached antenna to an integrated circuit.

[0016]

It will have turned out to be advantageous, if a signal detector is constituted so that the completeness of the transmitted protection circuit signal may be investigated in the case of evaluation. In the case of a digital protection circuit signal, comparison of comparison of the sum of the number of CRC check and width, a parity check, or a signature can perform this, for example. The following thing becomes possible by comparison of completeness with the perfect value of the protection circuit signal transmitted via the antenna, and the signal which are also called a reference signal and which is expected. That is, it becomes possible to eliminate the alteration of the protection circuit by comparison of only the identifier for detecting unjust action. In the case of this alteration, a signal detector is short-circuited in false and the same signal is supplied to a signal detector in contrast with a protection circuit also as a signal transmitted via the antenna also as a reference signal.

[0017]

The integrated circuit by this invention as an example which has at least one antenna for transmitting data or NERUGI by no contacting, and its advantage are explained in more detail based on figures below. The figure is as follows.

[0018]

The block diagram 1 of the advantageous antenna in the circuit structure drawing 2 circuit flat surface of the integrated circuit as an example of drawing 1 shows the structure of the integrated circuit by this invention roughly. Depiction of the circuit part which does not contribute to the function of this invention was omitted.

[0019]

This invention indicates the antenna 1 extended from the point A to the point B. The transceiver unit 5 to data communications and energy transmission is assigned to this antenna 1. This transmission is performed by the antenna 1 by no contacting. When data should be transmitted to an external receiver from an integrated circuit, it is generated in the transceiver unit 5 and this data is supplied to the antenna 1 via the point A of the antenna 1. In the antenna 1, it is supplied, the signal which should be transmitted is transmitted, and it is received, evaluated and displayed by the receiver assigned to the external antenna and the antenna as electromagnetic waves. When data is received by the integrated circuit, a suitable electromagnetism signal is captured by the antenna 1, and is changed into an electrical signal. This electrical signal is supplied to the transceiver unit 5

via the point B of the antenna 1. Here, the received signal is amplified and analyzed and is used with another integrated circuit which is not illustrated. It is also possible to transmit data by the abnormal conditions of the received electromagnetic field, and also to supply energy to an integrated circuit via the antenna 1. Since an integrated circuit is driven, this transmitted energy is used.

[0020]

The protection circuit signal formed by the signal generator 3 other than the data which should be transmitted is impressed to the antenna 1. This protection circuit signal ****'s to the data which should be transmitted, is supplied to the antenna 1 via the point A, and is transmitted to the point B via the conductor path of the antenna 1. From there, a protection circuit signal is supplied to the signal detector 4. Each supplied protection circuit signal is compared with a reference signal. This reference signal is supplied without a detour to the signal detector 4 via the antenna 1 from the signal generator 3. A reference signal expresses directly a signal which is expected after a signal passes the antenna 1, or this signal includes the indispensable information for detecting change by the unjust invasion of the protection circuit signal transmitted via the antenna 1. This kind of information can be formed by a completeness standard in the form which ****'s in the sum of a horizontal number, or it. An alarm signal will be generated if a significant difference is detected with the signal detector 4 between a reference signal and the signal received by the antenna 1. This alarm signal makes an integrated circuit shift to safety mode as a control signal. In this safety mode, the contents of the memory cell are not read any more as an example. It is because the information which the contents of the memory cell were thoroughly eliminated immediately after shifting to safety mode advantageously, and was included there with it is lost impossible [reproduction]. More than it of reading the important information included in the program memory and data memory of the integrated circuit by that cause, for example, a code key, a pin number, or a user's individual data or altering becomes impossible.

[0021]

Such change of the protection circuit signal on the transmission route of the antenna 1 is caused by the following thing. That is, it is caused by attaching punching stripping off for every layer, an alteration or observation, for example, the cover surface, of the integrated circuit from the outside, and a circuit flat surface, and a contact pin. The circuit part which should be protected as a part of protection circuit is covered, and such intervention itself to the integrated circuit which has the antenna 1 which reacts to such invasion by change of a signal prevents the invasion to the circuit part protected effectively. A significant change of a protection circuit signal is caused by change of the physical characteristic of the antenna 1. This change is produced, for example by a short circuit, cutting, resistance, or change of capacity.

[0022]

The antenna 1 follows and has a separate function in mutual [two]. An antenna acts as a means for transmitting data or energy by no contacting, and, on the other hand, acts as a

part of protection circuit. A protection circuit supervises the portion of an integrated circuit about undesirable invasion. By turns, these two functions are realized by time division multiplexing. For this reason, the selection element 2 is formed. It is connected with the transceiver unit 5 and the signal generator 3 thru/or the signal detector 4 for transmission of data, and, on the other hand, this selection element 2 is connected with the point A of the antenna 1 thru/or the point B. This selection element 2 is controlled by the control unit which is not illustrated as follows. That is, the selection element 2 is controlled to change the transceiver unit 5, and the signal generator 3 thru/or the signal detector 4 according to a function. Thereby, when operation of the antenna 1 of an integrated circuit is set up with a control unit, it can operate as a part of protection circuit, and when [another] set up, the operation as data or an antenna to uncontacted transmission of energy is possible for it. Therefore, an antenna is driven with a function which is variously different according to the circuit state of the selection element 2. Therefore, according to this invention, the following thing is possible. That is, it is not necessary to constitute the antenna 1 in multiplex as a protective shield as a transmission means of data or energy. By this, the die size to an integrated circuit decreases, and it follows, and the cost to an integrated circuit is reduced.

[0023]

Drawing 2 shows the advantageous composition of the antenna 1 in the circuit flat surface of an integrated circuit. The illustrated antenna 1 is constituted spirally and a thereby very dense conductor path structure is acquired. This conductor path structure makes the invasion in the spiral field of the antenna 1 result in the adjoining short circuit of a conductor path thru/or cutting of a conductor path. It is changed clearly by this and the protection circuit signal transmitted arises. This clear change is identified by the signal generator 4 as mentioned above, and an integrated circuit shifts to safety mode.

[0024]

Since it is arranged at the circuit flat surface which has a circuit part of an integrated circuit in the bottom of it in the lower part of the antenna 1 by constituting the antenna 1 flatly and spirally, therefore comes to be covered by the antenna 1, It becomes certain to receive invasion only by the destruction or invasion from the upper part which let this antenna 1 pass. However, such invasion is identified by the function of a protection circuit by the antenna 1, and is processed suitably. The antenna 1 is advantageously arranged at the best circuit flat surface and the lowest circuit flat surface of an integrated circuit, and, thereby, on the other hand, comprehensive protection of the circuit flat surface which exists between them is obtained. The transmission and reception characteristic over data or energy which was extremely excellent in the antenna is also acquired still more nearly additionally. In order to acquire the optimal transmitting characteristic thru/or receiving characteristic, an antenna is constituted as a coil which has many turns as much as possible. Thereby, the energy which can be transmitted can be raised. Change of the small signal showing the data which should be transmitted can also be received and detected. By constituting an antenna as a coil which has many turns as much as possible, even when

the whole area of the circuit flat surface of an integrated circuit with an usable interval between each turns is restricted, being chosen very narrowly is guaranteed. by positioning the invasion point between two conductor paths correctly, the danger of saying that the invasion to an integrated circuit is easy by this is markedly alike, and is reduced.

[Brief Description of the Drawings]

[Drawing 1]

Drawing 1 is a circuit structure figure of the integrated circuit as an example.

[Drawing 2]

Drawing 2 is a block diagram of the advantageous antenna in a circuit flat surface.

[Translation done.]

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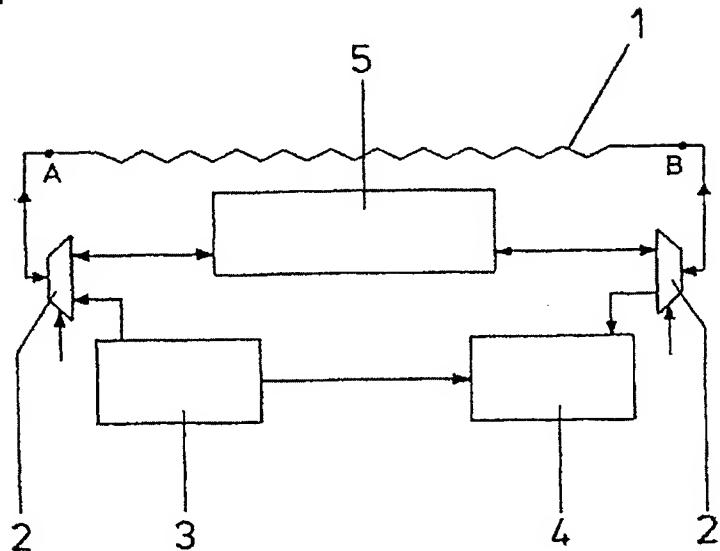
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DRAWINGS

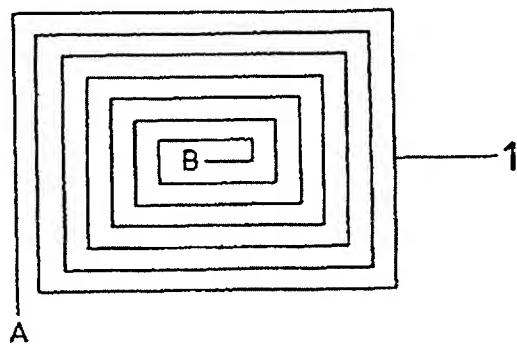
[Drawing 1]

FIG 1



[Drawing 2]

FIG 2



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WRITTEN AMENDMENT

[Written Amendment] Written Submission of Translation of Amendment under Article 34 of the Patent Cooperation Treaty

[Filing date] Heisei 13(2001) January 31 (2001.1.31)

[Amendment 1]

[Document to be Amended] Description

[Item(s) to be Amended] Claim 1

[Method of Amendment] Change

[The contents of amendment]

[Claim 1] It is an integrated circuit which has at least one antenna (1) for transmitting data or energy by no contacting,

In an integrated circuit of form of having a circuit flat surface arranged by this integrated circuit lapping up and down,

Said at least one antenna (1) is arranged at the upper part of a circuit part and/or a lower part which should be protected,

It is additionally connected with a protection circuit, or said antenna can be connected,

An integrated circuit characterized by what said protection circuit supervises an integrated circuit for about invasion.

[Translation done.]